Community-Wide Dental Mercury Study

PROJECT SUMMARY December 13, 2001

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Introduction

Since the control of mercury sources is an important environmental issue for state and federal regulators, the regulated community, including Metropolitan Council Environmental Services (MCES) is continually facing increasing pressure to reduce mercury emissions to the environment. As a result, this study was conducted cooperatively between MCES and the Minnesota Dental Association (MDA). A complete project report is available from Claude Anderson at (651) 602-8291.

Objectives

The Community-Wide Study was conducted to quantify the amount of mercury discharged from dental clinics to MCES' wastewater treatment plants (WWTPs). This was accomplished by an intensive sludge sampling and analysis program at the Hastings and Cottage Grove WWTPs before and during the time period amalgam removal equipment was in place treating wastewater at the dental clinics upstream of the WWTPs.

Methods

The Community-Wide Study was conducted in three phases; each phase included at least three months of data collection. The daily sludge sampling at the Hastings and Cottage Grove WWTPs was conducted between June of 1999 and August of 2001. The time periods and major activities for each phase were:

Phase I: Establish baseline at both treatment plants. June 18, 1999 to October 14, 2000

- Baseline was established for sludge mercury concentrations and mass loadings at the Hastings and Cottage Grove WWTPs.
- No amalgam removal equipment in place at any of the dental clinics.

Phase II: Hastings test phase. October 15, 2000 to February 17, 2001.

- Amalgam removal equipment was in placed in all dental clinics in the Hastings WWTP service area (6 clinics).
- No amalgam removal equipment in the Cottage Grove dental clinics.
- Additional Cottage Grove WWTP sludge baseline monitoring.
- At the end of this phase, amalgam removal equipment was removed from the Hastings dental clinics.

Phase III: Cottage Grove test phase. April 8, 2001 to July 21, 2001

- Amalgam removal equipment was in place at all but one of the dental clinics in the Cottage Grove WWTP service area (7 of 8 clinics).
- Additional Hastings WWTP sludge baseline monitoring.

During the transition periods between Phase II and Phase III, and after Phase III, sludge monitoring continued at the WWTPs even though equipment was being removed or installed at the dental clinics.

Results

During the study, a 44 % reduction in mercury loading to the Hastings WWTP sludge was measured while the amalgam removal equipment was in place in the Hastings dental clinics. The mercury sludge reduction at Cottage Grove was found to be 29% while the amalgam removal equipment was in place in Cottage Grove. These removals are represented graphically below.

Two possible reasons for a smaller reduction at Cottage Grove include
(1) one clinic (with one dentist) in Cottage Grove did not participate, and (2) the grit removal system at the Cottage Grove WWTP removes above normal quantities of grit, which may have resulted in less mercury reaching the sludge.

Based on the measured mercury sludge reductions at the wastewater treatment plants, and estimating the WWTP mercury grit removal rates, efficiency of the amalgam removal equipment in the dental offices and the number of days each clinic operated, a mercury loading from dental clinics was estimated. The mercury loading from dental clinics was estimated at 120 mg/dentist/operating day for each of the Hastings and Cottage Grove WWTP service areas. (Note that even though the calculation for each set of clinics within each service area was done independently, the result of 120 mg/dentist /operating day was the same.)

Major Conclusions and Recommendations

- This study found that significant decreases in mercury, as measured in wastewater treatment plant sludge, could be realized by installing amalgam removal equipment in dental clinics.

- The installation and operation of amalgam removal equipment in the 13 clinics did not result in any significant operating problems for the dental clinics during the three month installation period, either in terms of the amalgam removal equipment or the clinic vacuum systems.

- During the time period that amalgam removal equipment was in place upstream of the WWTP, the average reduction in the mass of mercury present in the sludge was 29 % at the Cottage Grove WWTP and 44 % at the Hastings WWTP. The reductions were estimated based on sludge volumes, moisture content, and mercury concentrations.

- Using the study data, a statistical comparison looked at the ratios of Hastings to Cottage Grove WWTP sludge mercury concentration and mass loadings with and without amalgam removal equipment in place. This comparison found that the differences observed for these ratios were statistically significant for both WWTPs when the amalgam removal equipment was in place.

- Based on the measured mercury sludge reductions and estimated grit removal rates at the wastewater treatment plants, the mercury loading from dental clinics was estimated to be 120 mg/dentist/operating day for the Cottage Grove and Hastings WWTPs.

- It was possible to get very high participation from the dentists in this study. This was possible because of the extensive pre-project involvement and support from the MDA and the dentists, in addition to the study's attention to minimizing adverse impacts on the dentists' practice. However, since involvement in this study was voluntary, it was not possible to get universal participation from all the dentists in the WWTP service areas.

- The Community-Wide Study demonstrated that significant reductions in WWTP sludge mercury loadings could be achieved if dental clinics treat their wastewater to reduce the amount of amalgam and mercury wastes prior to discharge to the sanitary sewer system. Therefore, it is recommended that a program to reduce dental clinic mercury be implemented. Development and implementation of a program should involve MCES, MDA, and possibly other state and local agencies.